Morganza to the Gulf of Mexico Numerical Model Study

US Army Engineer Research and Development Center

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Outline of this Presentation

1) Uncertainties and Expectations
2) Grid Domain and Boundary Conditions
3) Hydrodynamic Validation
4) Discharge Comparisons
5) Salinity Results

Uncertainties in Model Simulations

- Precise tidal boundary conditions
- Freshwater inflows
- Initial salinity conditions
- Gulf salinity for boundary conditions
- Winds – large uncertainty
- Rainfall – minor influence; ignored in model
- Supplemental tidal storage in unincluded wetlands
- Bathymetry
- Depth averaged => complete vertical mixing
- Limited field salinity data for initial conditions and verification of model

Required Tasks in Modeling that Affect Results

- Filtering of the tidal boundary conditions – ERDC mandate for numerical noise reduction
- Estimation of Gulf tidal and salinity BC
- Filtering of the wind measurements
- Bathymetry assumptions
- etc

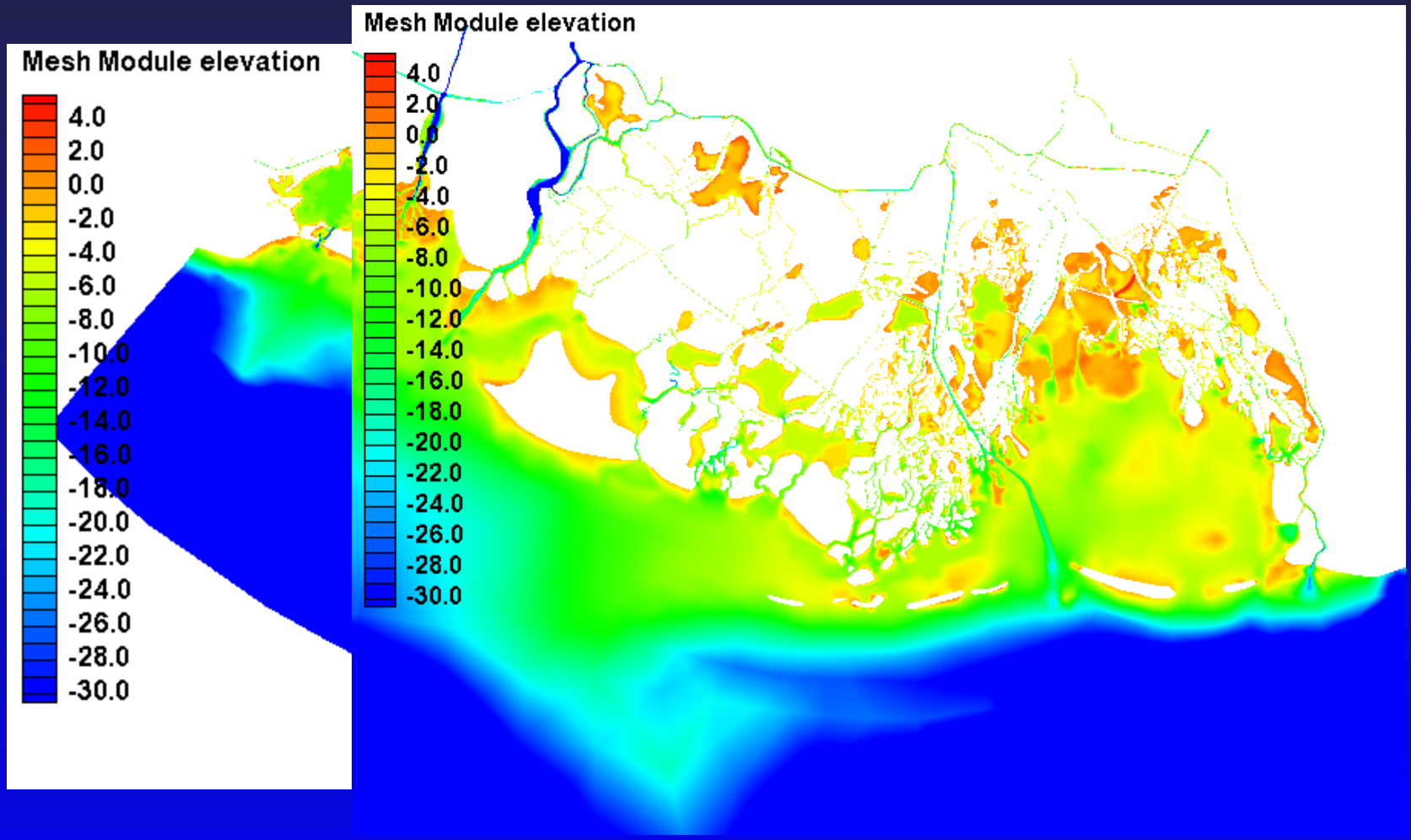
Consequences of Uncertainties

- Extreme high and low water levels may not be precisely matched.
- Precise matching of observed salinities is unlikely
- Better chance at mean salinities than extreme highs and lows in salinity
- Limited to a qualitative verification for salinity

Usefulness of the Model in Light of Uncertainties

- All models have uncertainties – boundary conditions and bathymetry are two major examples
- Sensitivity studies show the importance of these uncertainties
- Base-Plan comparisons indicate the kinds of changes the plan will make in the system

Model Domain



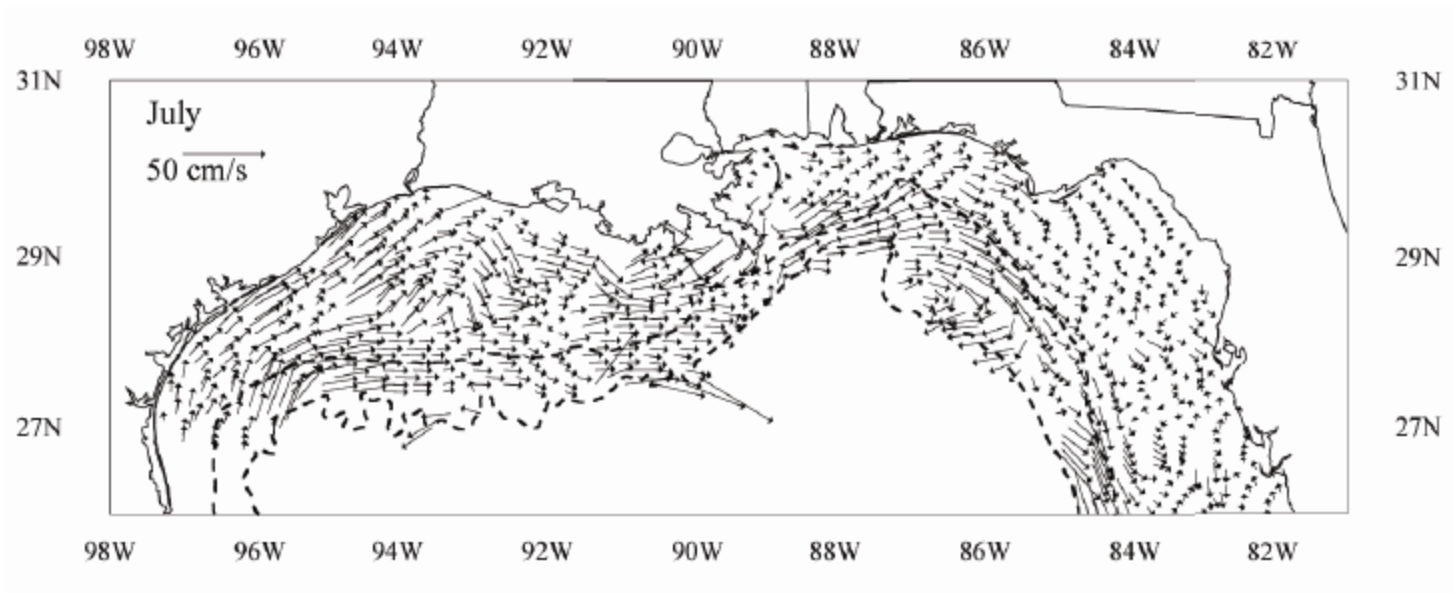
Tidal Boundary Conditions

Initially the Tidal boundary was created using the Eugene Island and the Port Fourchon NOAA Harmonics along with the Port Fourchon non-harmonic signal (meteorological effects).

By doing this the net effect was a higher water level on the western boundary of the grid creating a net gulf circulation to the East.

In the model, this forced the fresh water inflows from the Atchafalaya River to travel to the East thereby creating significantly fresher conditions than observed.

It has been documented that there exists a regional circulation in the Gulf of Mexico, but this circulation should have a current to the West, not the East.



Gulf of

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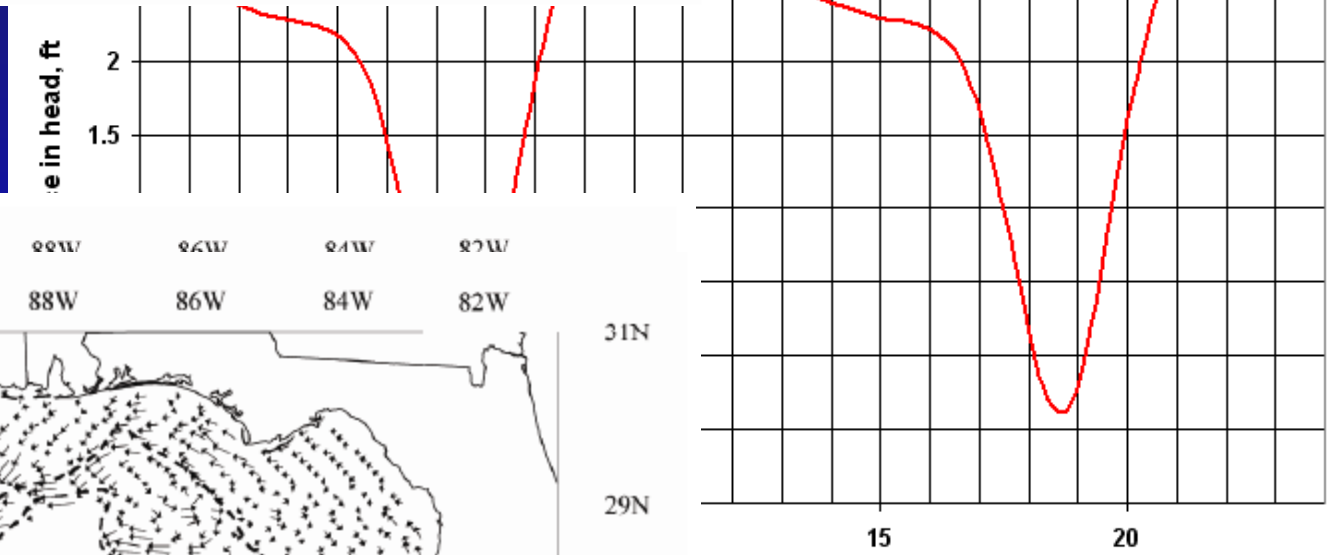

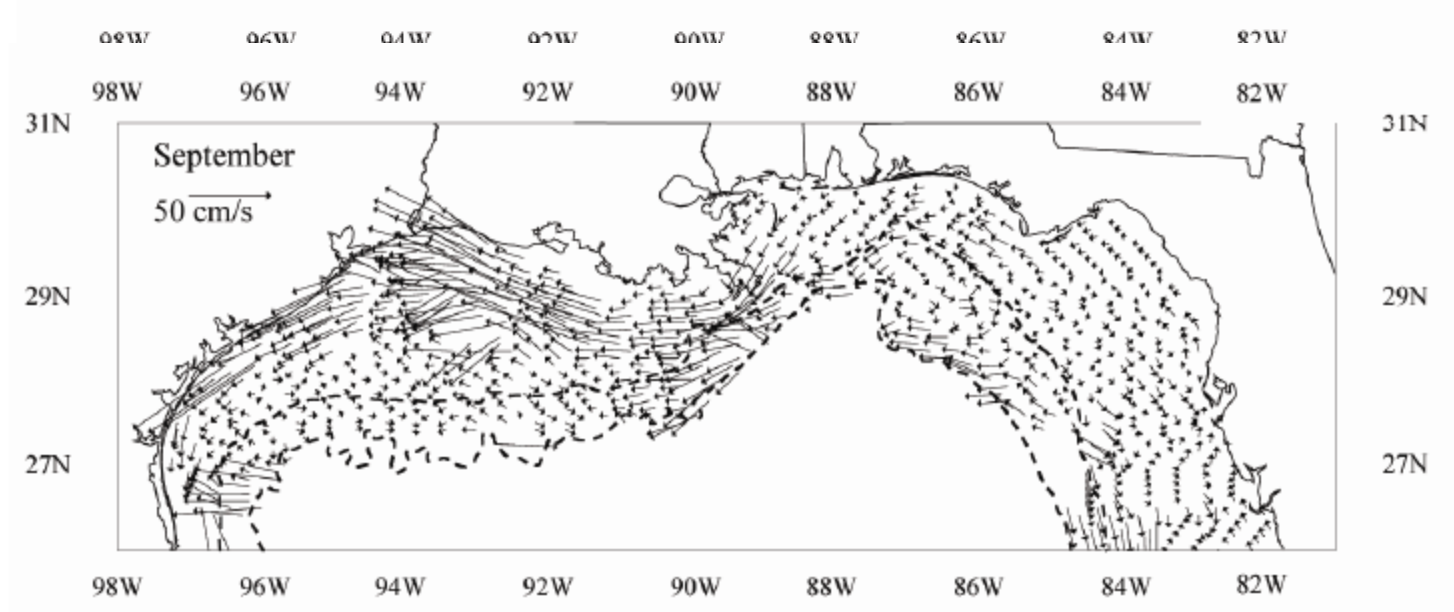

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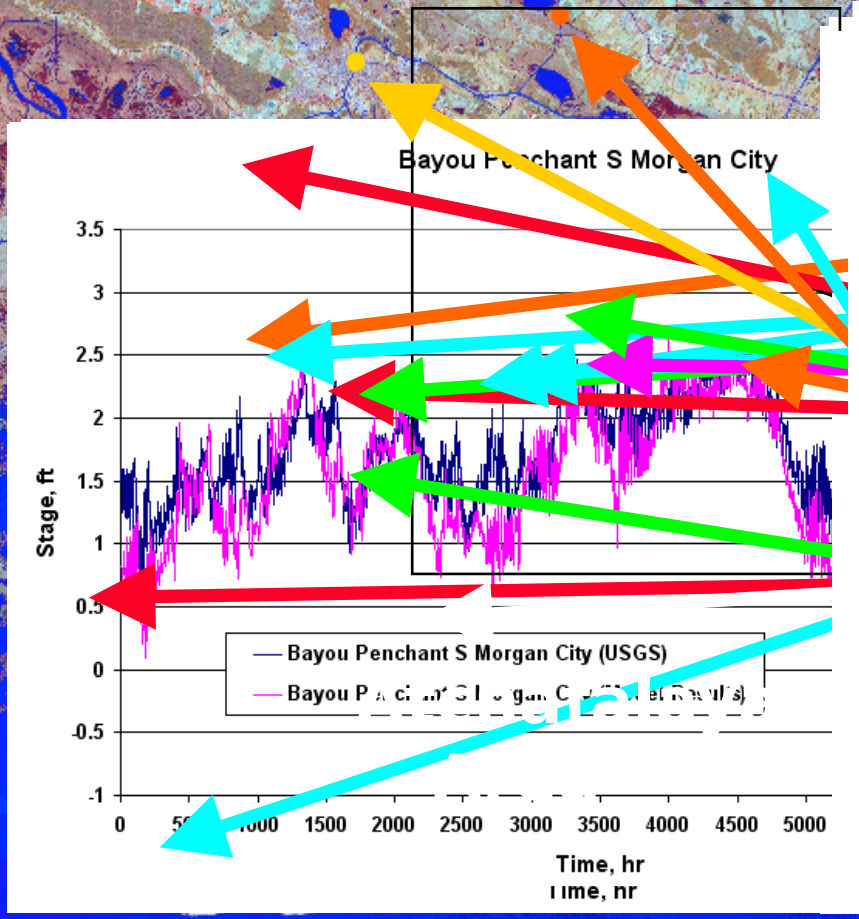
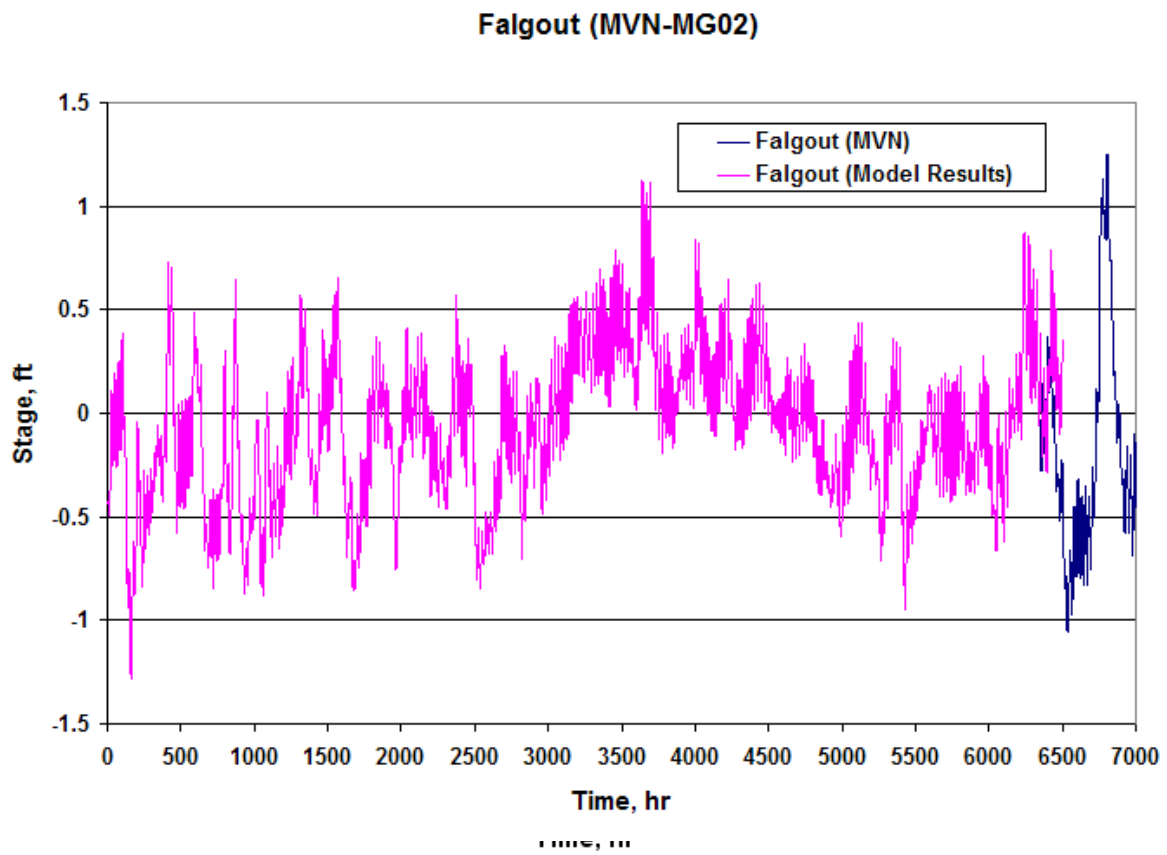
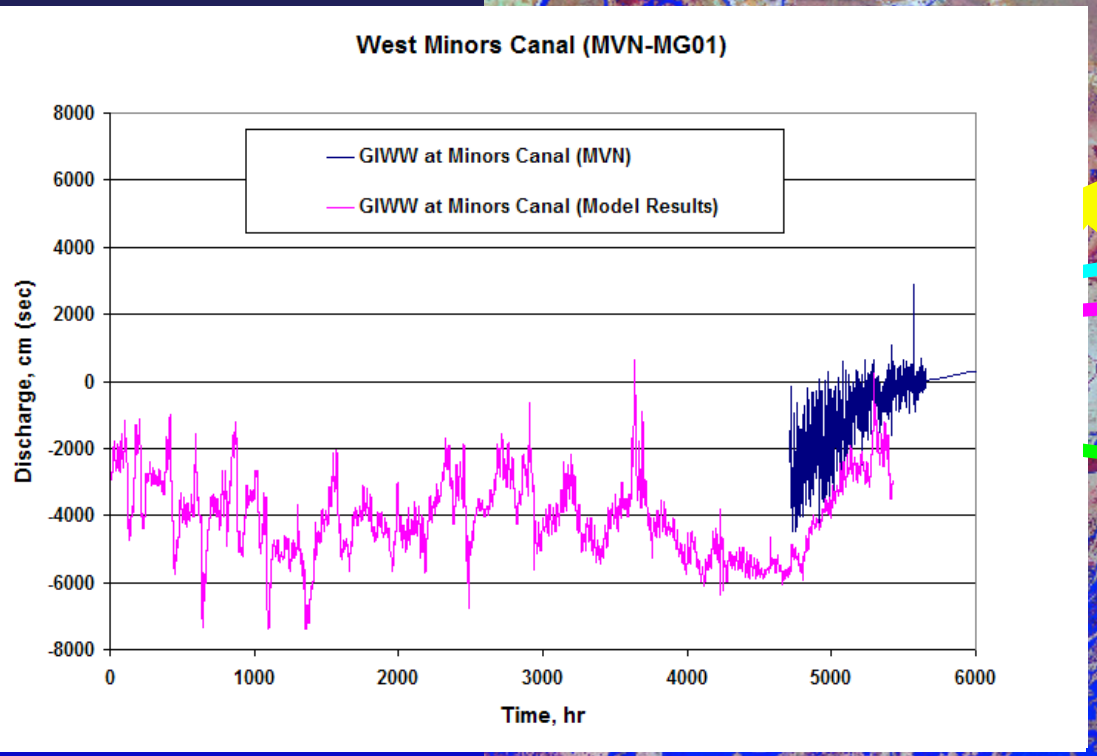
Water Surface Elevation Validation





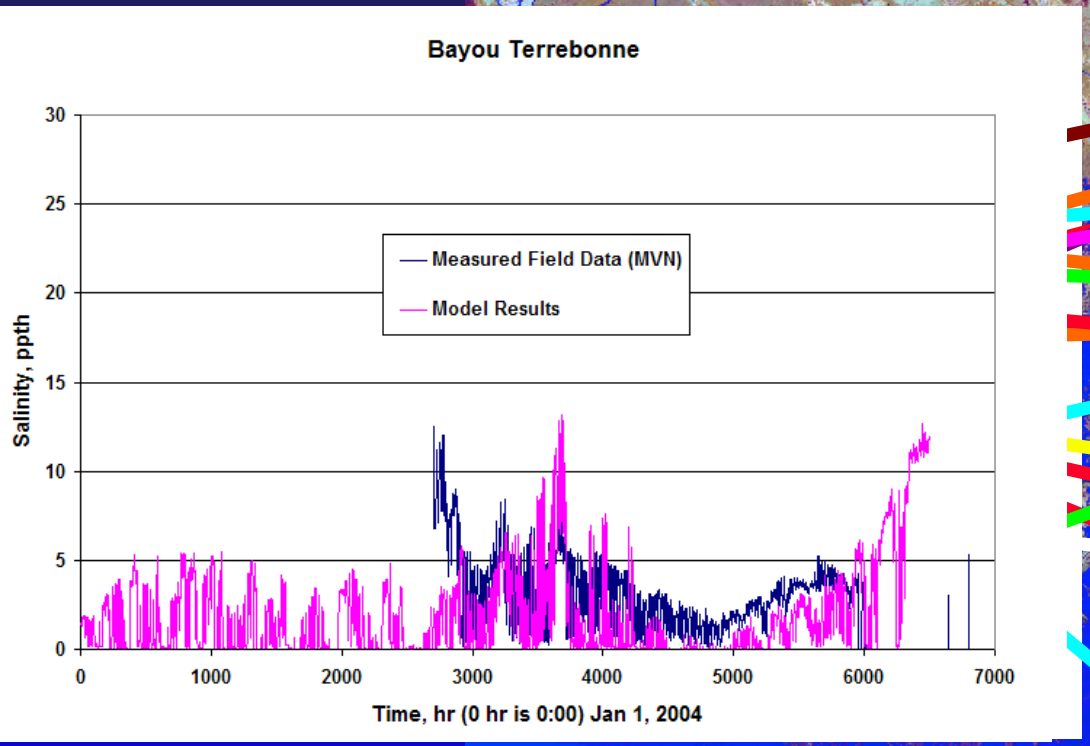
Discharge Validation



Factors Affecting Salinity in Project Area

- Atchafalaya River discharge
- Gulf salinity
- Winds
- Rainfall/evaporation
- Tidal exchange (wetlands)
- Vertical mixing in deeper channels
- Bathymetry
- Net Circulation in the Gulf of Mexico

Salinity Validation



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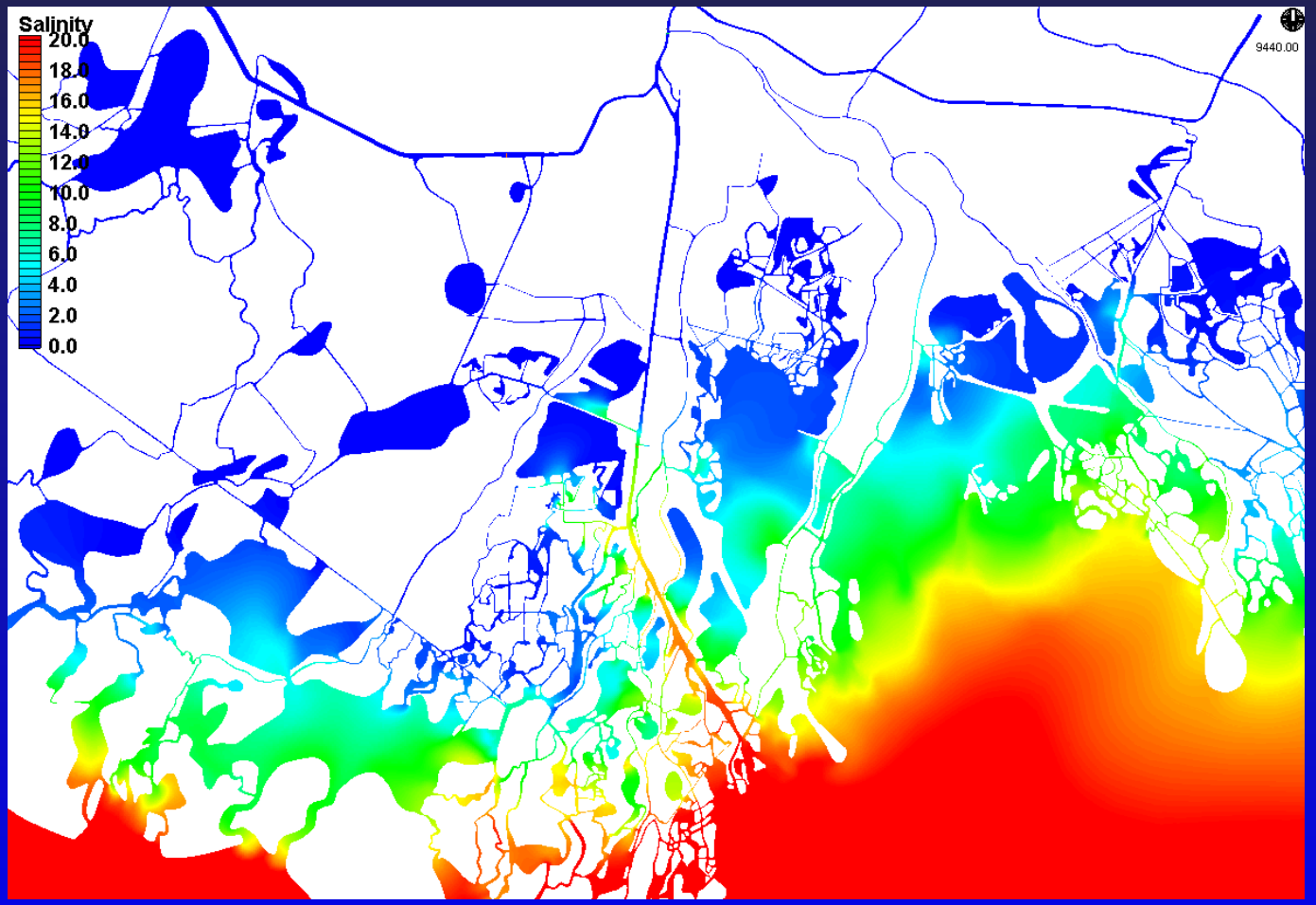
Animation of Salinity Results



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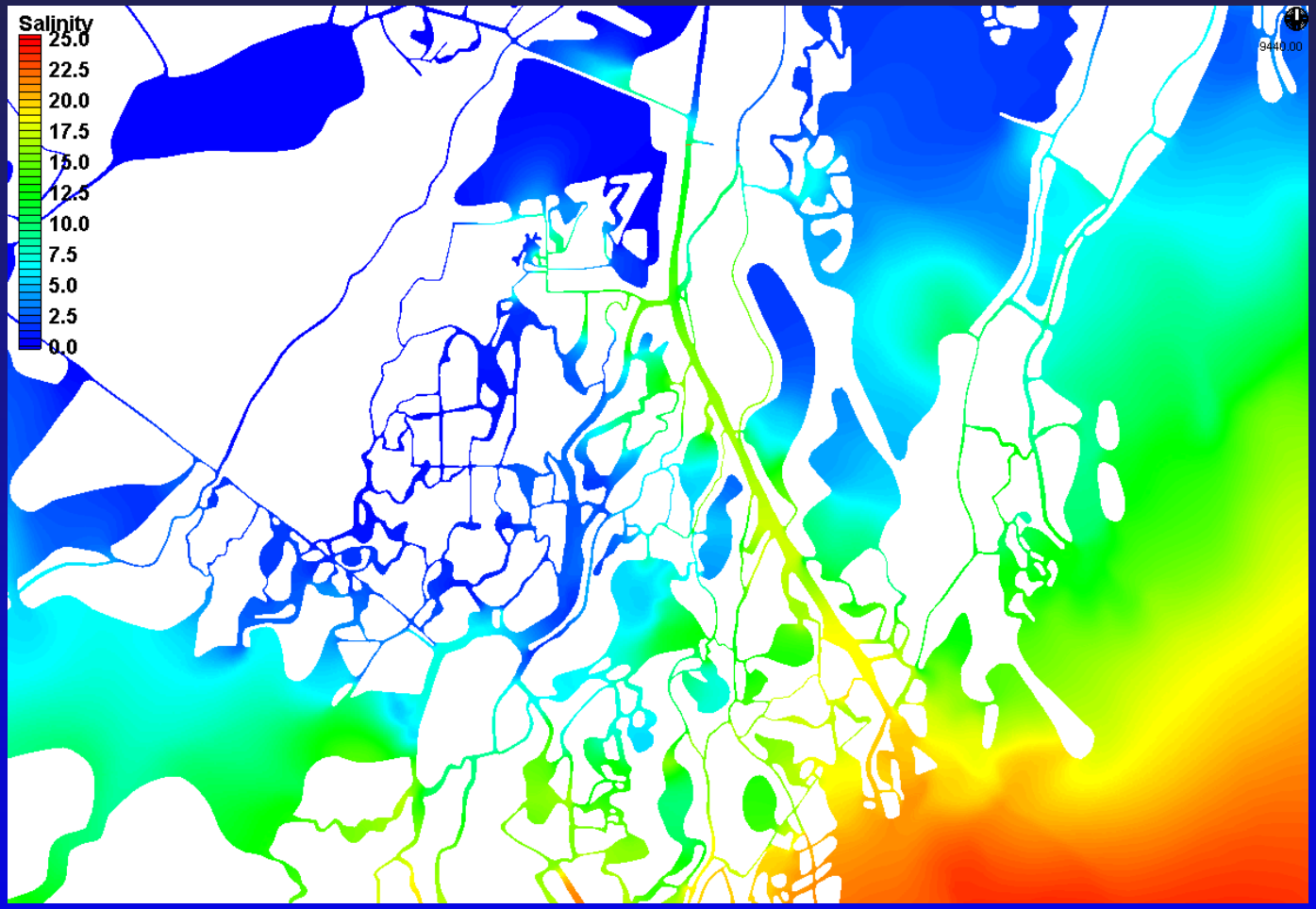

Questions?